Comprehensive Program Protection Planning

Paul R. Popick

Aerospace Corporation

***Paul.Popick.ctr@osd.mil/* 703 681-6563**

Phoenix Challenge Conference

April 26, 2012

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
APR 2012		**00-00-2012 to 00-00-2012**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Comprehensive Program Protection Planning	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Aerospace Corporation,2310 E. El Segundo Blvd,Los Angeles,CA,90245**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES
Presented at Phoenix Challenge Conference, at Lawrence Livermore National Laboratory, Livermore, CA. April 24-26, 2012,Government or Federal Purpose Rights License

14. ABSTRACT

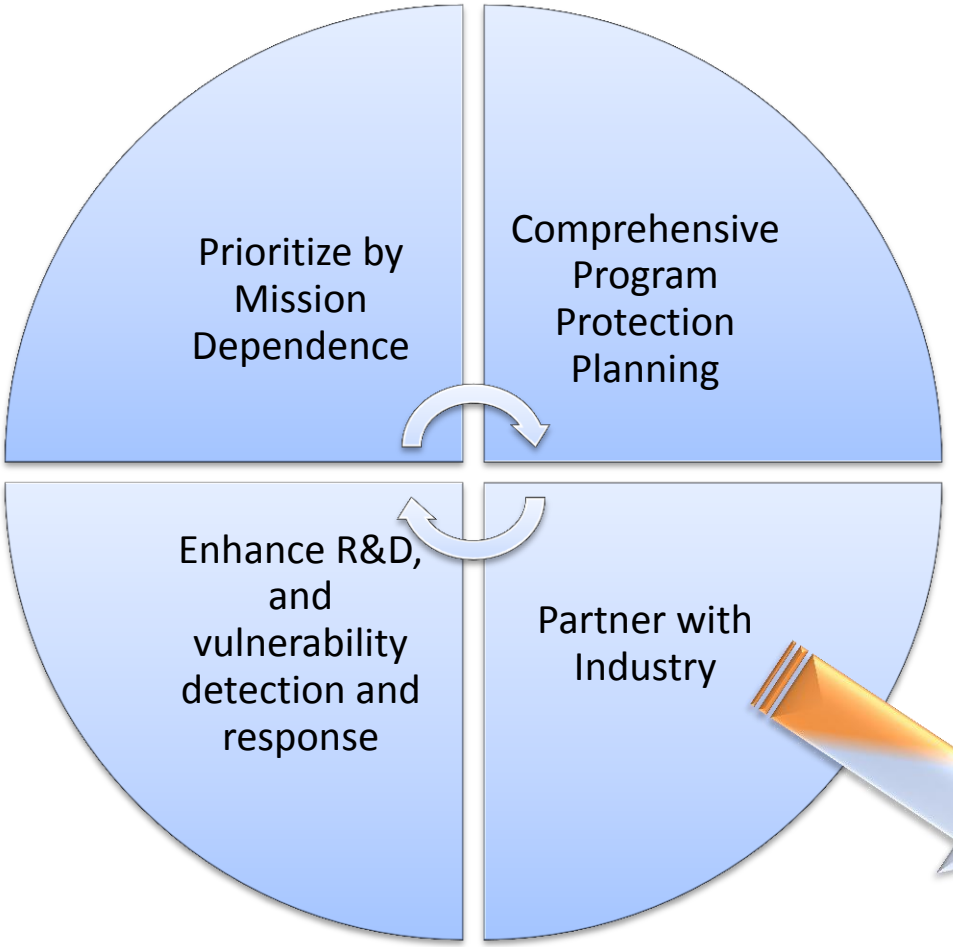
15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**12**	

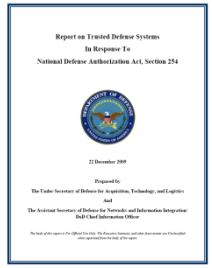
Trusted Defense Systems Strategy

Drivers/Enablers

- National Cybersecurity Strategies
- Congressional Interest
- DoD Policy and Directives
- Globalization Challenges
- Increasing System Complexity



Report on Trusted Defense Systems

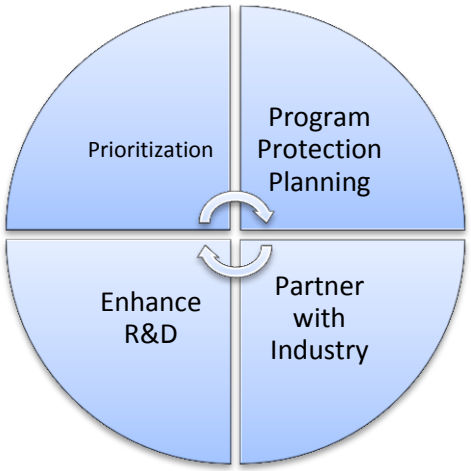


USD(AT&L)
ASD(NII)/DoD CIO

Delivering Trusted Systems

Trusted Defense Systems Strategy Basic Tenets

- **Prioritization:**
  - Focus security requirements on mission critical systems
  - Within systems, identify and protect critical components, technology, information
- **Comprehensive Program Protection Planning**
  - Early lifecycle identification of critical components
  - Provide PMs with analysis of supply chain risk
  - Protect critical components through trusted suppliers, or secure systems design
  - Assure systems through advanced vulnerability detection, test and evaluation
  - Manage counterfeit risk through sustainment
- **Partner with Industry**
  - Develop commercial standards for secure products
- **Enhance capability through R&D**
  - Leverage and enhance vulnerability detection tools and capabilities
  - Technology investment to advance secure software, hardware, and system design methods



Ensuring Confidence in Defense Systems

- ***Threat*: Nation-state, terrorist, criminal, or rogue developer who:**
  - Gain control of systems through supply chain opportunities
  - Exploit vulnerabilities remotely
- ***Vulnerabilities***
  - All systems, networks, and applications
  - Intentionally implanted logic
  - Unintentional vulnerabilities maliciously exploited (e.g., poor quality or fragile code)
- ***Traditional Consequences*: Loss of critical data and technology**
- ***Emerging Consequences*: Exploitation of manufacturing and supply chain**
- **Either can result in corruption; loss of confidence in critical warfighting capability**

Today's acquisition environment drives the increased emphasis:

Then		Now
Stand-alone systems	>>>	Networked systems
Some software functions	>>>	Software-intensive
Known supply base	>>>	Prime Integrator, hundreds of suppliers
CPI (technologies)	>>>	CPI and critical components

Program Protection Policy Framework

Signed

Draft

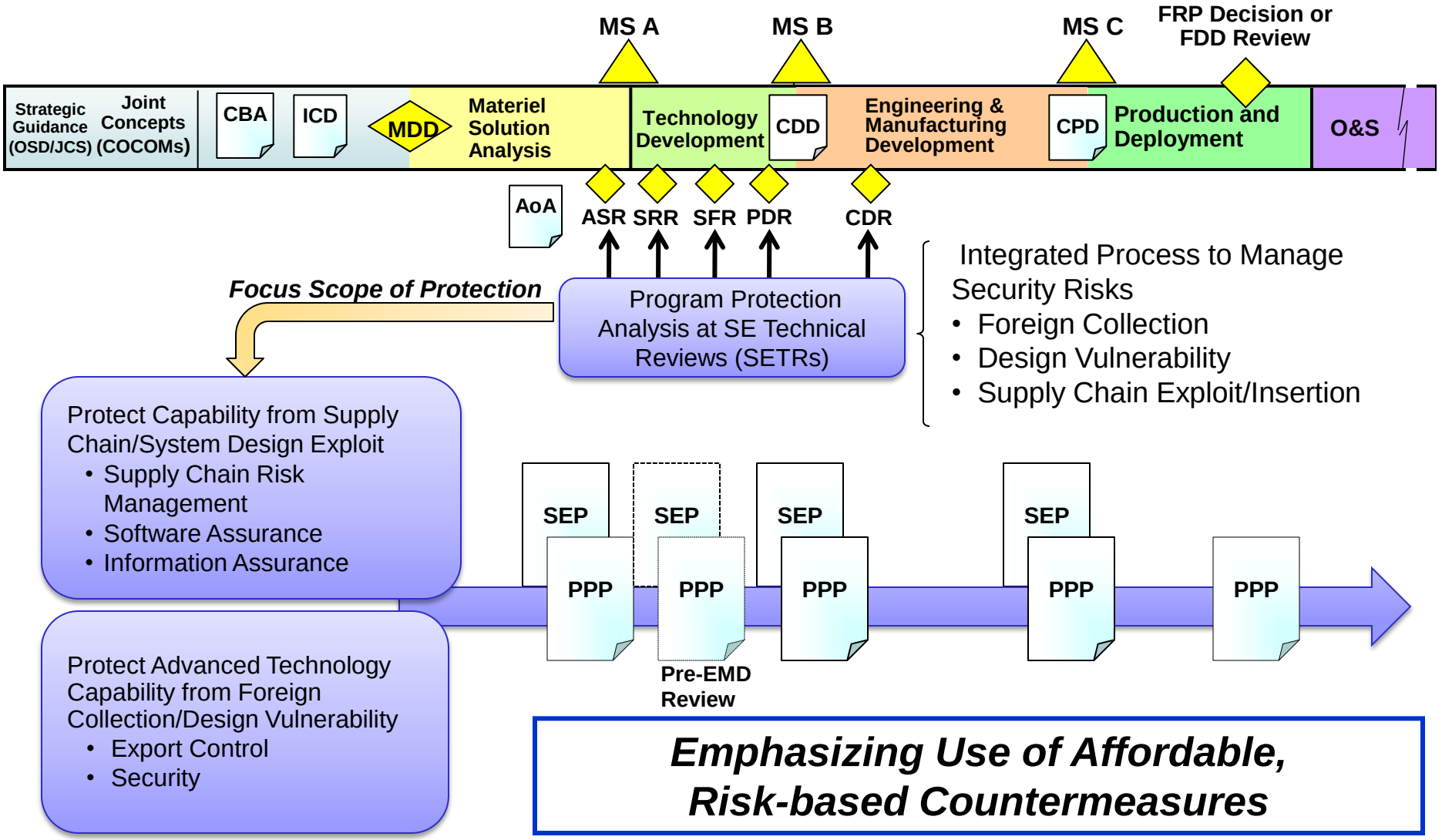
DoDI 5000.02 Enclosure 14: Program Protection

- PPP for every program at every milestone
- Identify CPI and critical functions/components
- Use Intelligence/Counterintelligence support to identify threats
- Use cost-effective countermeasures to mitigate risk
- Include IA Strategy with PPP
- Incorporate in T&E to ensure implementation

DoDI 5200.39 Protection of CPI	DoDI 5200.mm Trusted Systems and Networks	DoDD 8500.01 Information Assurance
Focus: Protect ***leading-edge research and technology*** from battlefield loss and unauthorized transfer Countermeasures: Anti-Tamper, Classification, Export Control, Security, Foreign Disclosure, and CI activities	Focus: Protect ***mission-critical functionality*** from compromise through system design or supply chain exploit Countermeasures: Supply Chain Risk Management (SCRM), Software Assurance (SwA), System Security Engineering (SSE)	Focus: Assure confidentiality, integrity, and availability of ***information*** and information systems Countermeasures: IA Controls (technical, process, management, awareness & training, etc.)

Complementary framework enables comprehensive Program Protection

Program Protection Embedded in Technical Reviews



Risk Assessment Methodology

Input Analysis Results:

Criticality Analysis Results

Mission	Critical Functions	Logic-Bearing Components (HW, SW, Firmware)	System Impact (I, II, III, IV)	Rationale
Mission 1	CF 1	Processor X	II	Redundancy
	CF 2	SW Module Y	I	Performance
Mission 2	CF 3	SW Algorithm A	II	Accuracy
	CF 4	FPGA 123	I	Performance

Vulnerability Assessment Results

Critical Components (HW, SW, Firmware)	Identified Vulnerabilities	Exploit-ability	System Impact (I, II, III, IV)	Exposure
Processor X	Vulnerability 1 Vulnerability 4	Low Medium	II	Low Low
SW Module Y	Vulnerability 1 Vulnerability 2 Vulnerability 3 Vulnerability 6	High Low Medium High	I	High Low Medium Low
SW Algorithm A	None	Very Low	II	Very Low
FPGA 123	Vulnerability 1 Vulnerability 23	Low Low	I	High High

Supplier Risk Analysis Results

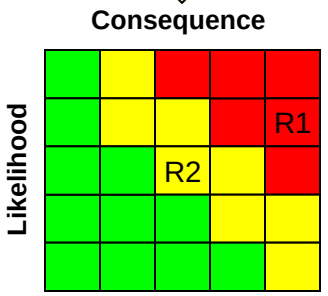
Supplier	Critical Components (HW, SW, Firmware)	Analysis Findings
Supplier 1	Processor X	Supplier Risk
	FPGA 123	Supplier Risk
Supplier 2	SW Algorithm A	Cleared Personnel
	SW Module Y	Cleared Personnel

Risk Mitigation and Countermeasure Options

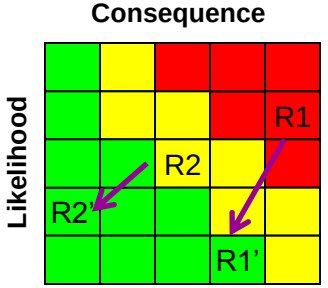
Consequence of Losing Mission Capability
Very High
High
Moderate
Low
Very Low

Likelihood of Losing Mission Capability
Near Certainty (VH)
Highly Likely (H)
Likely (M)
Low Likelihood (L)
Not Likely (VL)

Initial Risk Posture



Risk Mitigation Decisions



International Community System Assurance Activities

- **ISO/IEC 15026 – System and Software Engineering – Systems and Software Assurance**
  - Establishes common assurance concepts, vocabulary, integrity levels and lifecycle
- **ISO/IEC 27036—IT Security Techniques—Supplier Relationships**
  - Establishes techniques between acquirer and supplier for supply chain risk management
- **International Council on Systems Engineering (INCOSE)**
  - Systems Security Engineering (SSE) working group established to develop SSE updates to INCOSE SE Handbook
- **The Open Group (TOG)**
  - The Open Trusted Technology Provider Framework (O-TTPF) - open standard that codifies best practices across the entire lifecycle covering:
    - Product Development
    - Secure Engineering
    - Supply Chain Integrity
    - http://www.opengroup.org/ogttf/

System Security Engineering (SSE) Research Activities

DoD is leveraging the Systems Engineering Research Center (SERC) —a DoD University Affiliated Research Center led by Stevens Institute with over 20 collaborating university partners—to advance SSE

- **Published the SSE Research Roadmap in August 2010**

  - Outlines approach for advancing SSE definitions, metrics, frameworks, and human capital through coordinated research modules
  - Captures input from 50+ industry, academia, and government experts

- **Conduct follow-on research into "System Aware" Security**

  - Prototype secure design patterns and study system performance impacts
    - Physical and virtual configuration hopping
    - Diverse redundancy of components
    - Voting mechanisms
  - Develop scoring model for evaluating efficacy of security solutions
    - Identify contribution of individual security services
    - Determine effectiveness of security services within a security architecture
    - Evaluate cost and collateral impacts

In Summary

- **Holistic approach to security is critical**
  - To focus attention on the threat
  - To avoid risk exposure from gaps and seams
- **Program Protection Policy provides overarching framework for trusted systems**
  - Common implementation processes are beneficial
- **Stakeholder integration is key to success**
  - Acquisition, Intelligence, Engineering, Industry, Research Communities are all stakeholders
- **Systems engineering brings these stakeholders, risk trades, policy, and design decisions together**
  - Informing leadership early; providing programs with risk-based options

Questions?